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Comparison of frequency-selective properties of meteor burst channel at the beginning and at the end of radio reflections from meteor trails

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Abstract

© 2017 IEEE. Meteor burst propagation is based on scattering of radio waves from the ionized trails left by fast meteor particles. One of the promising applications of meteor radio propagation is development of Meteor Synchronization Systems (MSSs) for synchronizing two remote stations with potentially subnanosecond accuracy. Frequency-selective properties of meteor burst channel limit potential accuracy of coherent multi-carrier MSS systems. To adapt to frequency distortions of timing signals, a frequency response of the channel should be appropriately considered. Continuous expansion of the meteor trail plasma due to ambipolar diffusion provokes significant changes in frequency-selective properties of the channel at the end of detection of radio reflections. This should be taken into account to assess a minimum channel bandwidth correctly. On the basis of rigorous solution to the problem of diffraction of radio waves on a meteor trail, we perform a numerical simulation of the amplitude-frequency and phase-frequency responses of meteor burst channel. A comparison of the frequency-selective properties of the channel at the beginning and at the end of the signal detection is presented for the cases of radio reflections from underdense and overdense meteor trails. The frequency responses obtained with the diffraction approach are compared with the results of the classical (approximate) theory of a radio reflection from meteor trail.

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Keywords

Diffraction of radio waves, Frequency response of channel, Meteor burst propagation, Meteor radio reflection

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